New work item proposal. Costs of VOC mitigation techniques

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An opportunity: EU STS BREF revision

- The current version of the EU Best Available Techniques REFerence document on Surface Treatment using organic Solvents was published in 2007.
- Between 2003 and 2006, EGTEI worked on the issue of costs related to VOC mitigation techniques, for the purpose of the LRTAP Convention and in close cooperation with the STS BREF Technical Working Group.
- This work was very comprehensive, since a wide array of sectors were covered: synopsis sheets on techno-economic data were produced for 15 industrial sectors and shared with the STS BREF TWG.
- Cooperation between the two groups was very fruitful:
  - *many EGTEI inputs are referenced throughout the whole BREF;*
  - *Section 24.1.1 is dedicated to the EGTEI work*
- STS BREF revision is likely to start in Q2 2015.
- This is considered as a good opportunity to update cost data gathered by EGTEI ten years ago

Mirror group in France

- The French mirror group was established when the current STS BREF was issued.
- It is composed of different stakeholders: industrial operators from sectors using organic solvents, independent experts, equipment suppliers, local authorities.
- How does it work? It is co-chaired by ADEME and the French Ministry in charge of Ecology, Sustainable Development and Energy. It meets on a regular basis (five times since Dec. 2013)
- The issue of costs has been raised by several stakeholders (e.g. operators from the automotive industry)
- France proposes to share this issue at the international level and to exchange information on cost data of VOCs abatement technologies through EGTEI in 2015, on the basis of the work that has already been carried out in 2003-2006

Available data - EGTEI works (2003 to 2006)

Industrial sectors considered by EGTEI and covered by the BREF STS

- ✓ Coating of cars
- ✓ Coating of truck cabins
- ✓ Coating of trucks and vans
- ✓ Coating of Bus
- ✓ Coil coating
- ✓ Uses of paints in industry (other than the previous ones):
  - General Industry (trade coaters, general engineering, industrial equipment, heavy engineering)
  - Can coating
  - General industry : plastic components
  - Automotive OEM components
  - Wood coating

Industrial sectors considered by EGTEI and covered by the BREF STS

- ✓ Heat set offset
- ✓ Edition heliogravure
- ✓ Packaging printing (flexography, heliogravure…)
- ✓ Coating of wires
- ✓ Adhesive manufacturing
- ✓ Surface cleaning with solvent

Available data - EGTEI works (2003 to 2006)

Industrial, domestic sectors considered by EGTEI not covered by the BREF STS

- ✓ Do it yourself paints
- ✓ Uses of paints in building activities
- ✓ Dry cleaning
- ✓ Vehicle refinishing
- ✓ Tyre production
- ✓ Speciality chemistry
- ✓ Fat edible and non edible oil extraction
- ✓ Manufacture of paints, inks and glues
- ✓ Preservation of wood

Methodology used by EGTEI for cost definition

For each sector considered:

- Definition of one or several “reference” installations assumed to be representative of plants encountered in the sector, not equipped with abatement technique
- Determination of applicable reduction measures, both primary and secondary measures and their efficiency
- Investment and operating costs estimated in close collaboration with expert from industry

Other possibilities offered to experts from Parties:

- Possibility for experts from Parties to use the information provided to calculate the total costs due to adoption of reduction techniques in a sector, providing the percentage of each reference installation considered and the total activity level

Available data - EGTEI works (2003 to 2006)

Exemple of primary measures defined for car manufacturing

Primary Measure Code PMC	Description
00	20 % one-coat topcoat (solids coat); 80 % two-coat topcoat (basecoat/clearcoat) • Electrocoat: water-based (5 wt.-% solvent content) • Primer: solvent-based (45 wt.-% solvent content) - electrostatic application • Topcoat : - High solid coat (45 wt.-% solvent content) - electrostatic application, **and** - solvent-based basecoat (75 wt.-% solvent content) – pneumatic application (50 %) and electrostatic application (50 %) – and solvent-based clear coat (45 wt.-% solvent content) - electrostatic application • Solvent management plan, recovery of purge solvent
01	20 % one-coat topcoat (solids coat); 80 % two-coat topcoat (basecoat/clearcoat) • MC 00 + water-based (8 wt.-% solvent content) - electrostatic application
02	20 % one-coat topcoat (solids coat); 80 % two-coat topcoat (basecoat/clearcoat) • MC 00 + water-based basecoat (13 wt.-% solvent content) – electrostatic application
03	20 % one-coat topcoat (solids coat); 80 % two-coat topcoat (basecoat/clearcoat) • MC 00 + water-based (8 wt.-% solvent content) - electrostatic application + water-based basecoat (15 wt.-% solvent content) – electrostatic application

Exemple of primary measures defined for car manufacturing

	Emissions kg VOC/ veh.	Investment M€	Unit cost €/t abatted	Unit cost €/veh
No measure	7.6			
Primary measure 1	6.8	5.5	6400	5
Primary measure 2	4.5	20	12500	39
Primary measure 3	3.6	27.3	11300	45

Available data - EGTEI works (2003 to 2006)

Exemple of heat set web offset

Primary measures	Description
00	Conventional heat set ink (content of 45 wt.-% mineral oils) and impregnation with isopropanol and solvent-based cleaning agents. Fugitive emission of 45% of solvent input
01	Conventional heat set ink (content of 45 wt.-% mineral oils) and reduced consumption of isopropanol and of cleaning agents with high flash points. Fugitive emissions of 30% of solvent input
02	Conventional heat set ink (content of 45 wt.-% mineral oils) and reduced consumption of isopropanol and of cleaning agents with high flash points. Fugitive emissions of 25% of solvent input

Secondary measures	Description
00	No secondary measure
01	Thermal oxidiser

Exemple of of heat set web offset

	VOC emissions EF [kg VOC / t ink]	Investment M€	Unit cost €/t VOC abatted	Unit cost €/t ink
No measure	727			
Without primary measures and thermal oxidation	376	1.39	800	300
With primary measure and thermal oxidation	203	1.550	600	300

Cost components considered

Total annual cost

$$C_{tot}\left[\frac{€}{year}\right] = C_{cap}\left[\frac{€}{year}\right] + C_{op}\left[\frac{€}{year}\right]$$

Annualised capital cost

$$C_{cap}\left[\frac{€}{year}\right] = C_{inv} \cdot \frac{(1+p)^n}{(1+p)^n - 1} \cdot p$$

Composition of OPEX

$$C_{op}\left[\frac{€}{year}\right] = C_{op,fix}\left[\frac{€}{year}\right] + C_{op,var}\left[\frac{€}{year}\right]$$

Fixed operating cost

$$C_{op,fix}\left[\frac{€}{year}\right] = C_{inv}[€] * f_{O\&M}\left[\frac{\%}{year}\right]$$

Variable operating cost

$$C_{op,var}\left[\frac{€}{year}\right] = \sum C^{unit}\left[\frac{€}{year}\right]$$

p = actualisation rate| n = technical life time of the equipement,

Cost components considered

Total annual cost

$$C_{tot}\left[\frac{€}{year}\right] = C_{cap}\left[\frac{€}{year}\right] + C_{op}\left[\frac{€}{year}\right]$$

Annualised capital cost

$$C_{cap}\left[\frac{€}{year}\right] = C_{inv} \cdot \frac{(1+p)^n}{(1+p)^n - 1} \cdot p$$

C_{inv}: Total investment

$\frac{(1+p)^n}{(1+p)^n-1} \cdot p$: Fct of the discount (interest) rate and the technical lifetime

p = actualisation rate| n = technical life time of the equipement,

Cost definition

Cost components considered

Total annual cost

$$C_{tot}\left[\frac{€}{year}\right] = C_{cap}\left[\frac{€}{year}\right] + C_{op}\left[\frac{€}{year}\right]$$

Annualised capital cost

$$C_{cap}\left[\frac{€}{year}\right] = C_{inv} \cdot \frac{(1+p)^n}{(1+p)^n - 1} \cdot p$$

Composition of OPEX

$$C_{op}\left[\frac{€}{year}\right] = C_{op,fix}\left[\frac{€}{year}\right] + C_{op,var}\left[\frac{€}{year}\right]$$

Fixed operating cost

$$C_{op,fix}\left[\frac{€}{year}\right] = C_{inv}[€] * f_{O\&M}\left[\frac{\%}{year}\right]$$

Consider maintenance, insurance, technical staff
Most often a percentage of the investment

Cost components considered

Total annual cost	$C_{tot}\left[\frac{€}{year}\right] = C_{cap}\left[\frac{€}{year}\right] + C_{op}\left[\frac{€}{year}\right]$
Annualised capital cost	$C_{cap}\left[\frac{€}{year}\right] = C_{inv} \cdot \frac{(1+p)^n}{(1+p)^n - 1} \cdot p$
Composition of OPEX	$C_{op}\left[\frac{€}{year}\right] = C_{op,fix}\left[\frac{€}{year}\right] + C_{op,var}\left[\frac{€}{year}\right]$
Fixed operating cost	$C_{op,fix}\left[\frac{€}{year}\right] = C_{inv}[€] * f_{O\&M}\left[\frac{\%}{year}\right]$
Variable operating cost	$C_{op,var}\left[\frac{€}{year}\right] = \sum C_{unit}\left[\frac{€}{year}\right]$

Components depend on techniques but most often: electricity, water, energy, reagents
Benefits considered if existing (valorisation of by products)

p = actualisation rate| n = technical life time of the equipement,

Data provided

- Clear presentation of parameters considered (transparency obtained) and methods and references used to define them:
- ✓ Investments [€], variable operating costs [€/year] and total annual costs [€/year]
- ✓ Cost efficiency [€/t pollutant avoided] or specific costs [€/ unit of production] presented

- Two types of documents prepared per activity:
- ✓ Background document: technical details on reduction techniques considered and cost estimation (all assumptions presented)
- ✓ Synopsis sheet: summary with one example developed for one country (France)

Proposal

In a first step:

- ✓ Prioritize the work on large plants consuming more than 200 t solvent/year (thresholds considered in annex I of IED directive)
- ✓ Focus on activities considered by the BREF STS

In a second step:

- ✓ Consider the whole range of size of installations from the thresholds of annex VI of the Gothenburg Protocol (for memory, annex VI implements VOC ELVs for plants, from solvent consumption from 0.5 t/y; 2 or 5 t/y or even larger)
- ✓ Consider other activities covered by annex VI of the Gothenburg Protocol

A future work of EGTEI on VOCs?

Simplification suggested

- ✓ Reduce the number of reference installations considered
- ✓ Only provide an EXCEL tool for estimating country specific costs for an installation (not the whole sector)